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GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
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MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE,
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ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

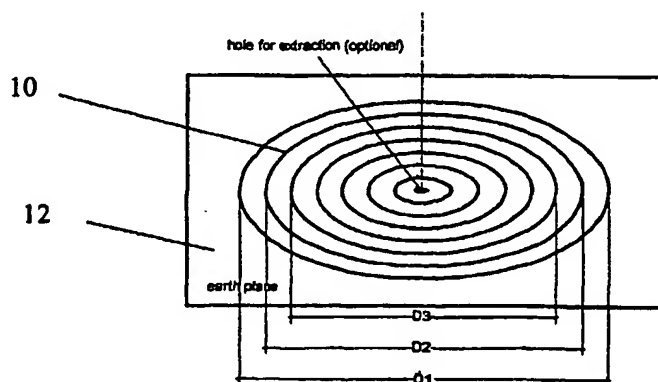
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(54) Title: CHARGED PARTICLE MANIPULATION



(57) Abstract: Methods and apparatus are provided for manipulating the phase space of at least one charged particle, wherein a combination of alternating current and direct current voltages applied to an electrode forms a potential which provides a region of phase space manipulation, and wherein the at least one charged particle is situated to one side of the electrode surface. A number of applications are applicable, which include a spot trap, a conveyor belt, a funnel, and ways of holding different types of particles at different distances from an array so that they can be manipulated.

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European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
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SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
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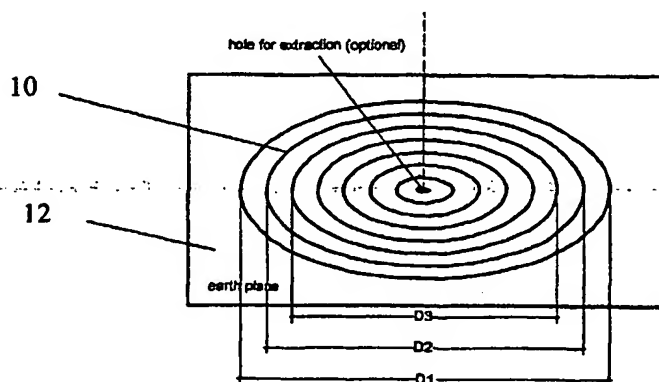
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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 206 506 A (KIRCHNER NICHOLAS J.) 27 April 1993 (1993-04-27)	1-11, 13, 17-22, 24, 27, 29, 32-37, 40, 41, 46-60, 65-69, 72, 74, 75, 80-85, 87-91, 95, 96
Y	column 14	12, 60
A		22, 23, 38, 45, 70, 71
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☒ Patent family members are listed in annex.

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- *Z* document member of the same patent family

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 43 18 872 A (MOELLER HAMBURG GMBH CO KG) 8 December 1994 (1994-12-08) claims	12,60

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5206506	A	27-04-1993	AU 643653 B2	18-11-1993
			AU 1469392 A	07-09-1992
			CA 2079910 A1	13-08-1992
			DE 69210496 D1	13-06-1996
			DE 69210496 T2	09-01-1997
			EP 0524311 A1	27-01-1993
			JP 2865865 B2	08-03-1999
			JP 5509437 T	22-12-1993
			WO 9214259 A1	20-08-1992
DE 4318872	A	08-12-1994	DE 4318872 A1	08-12-1994